OPERATING AND SERVICE MANUAL

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K101-D/K102-D INTERFACE ADDENDUM

OPERATING NOTE

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GOULD

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K101-D/K102-D INTERFACE ADDENDUM

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SECTION IV

COMMUNICATIONS INTERFACING

4-1. INTRODUCTION

In general, the GPIB and RS-232-C interfaces allow the user to operate the K101-D/K102-D from the GPIB controller in a manner comparable to pressing keys when the K101-D/K102-D is operated from the front panel keyboard. Each key on the front panel (except the AC power switch) can be logically "pressed" with the appropriate command. The only way to hold a key in a continuously "pressed" position (e.g., to cause a cursor to move continuously) is if the terminal is equipped with an auto repeat function.

Both interfaces utilize the same Record Formats to perform data transfers, which are specified in Section 4-5. The operating modes, parameters and selections unique to GPIB and RS-232-C operations are specified in Section 4-2 and 4-4 respectively, including the interface selections allowable from the K101-D/K102-D front panel.

NOTE

This document contains preliminary information. Prior knowledge of the normal (non-GPIB) use of the K101-D/K102-D Logic Analyzer as contained in the Operation and Service Manual is assumed. For elaboration on specific points, or question regarding items not covered in the text, please consult the factory directly.

4-2. GPIB OPERATION

General Description

The K101-D/K102-D GPIB is an implementation of the IEEE GPIB STANDARD 488-1978. The K101-D/K102-D GPIB supports the following functions as defined by the STANDARD:

Source Handshake	(SH1)	Complete Capability
Acceptor Handshake	(AH1)	Complete Capability
Talker Function	(T5)	Basic Talker Talk Only Unaddress if 'MLA'
Talker Function Address Extension	(TE0)	No Capability
Listener Function	(L3)	Basic Listener

		Serial Poll Listen Only Unaddress if 'MTA'
Listener Function with Address Extension	(LE0)	No Capability
Service Request	(SR1)	Complete Capability
Remote Local Function	(RL1)	Complete Capability
Parallel Poll Function	(PP1)	Remote Configuration
Device Clear Function	(DC1)	Complete Capability
Device Trigger Function	(DT1)	Complete Capability
Controller Function	(C0)	No Capability

4-3. GPIB OPERATING MODES AND MESSAGES

Talk/Listen Mode:

LISTENER: As a listener, the K101-D/K102-D will process keys sent to its listen address while it is in remote mode. Six types of records may be sent to the K101-D/K102-D when it is addressed to listen. KEYSTROKE records, MEMORY records, COMMAND records, DISPLAY records, PORT records, and ACQUISITION TIME records.

TALKER: When the K101-D/K102-D is addressed to talk, it will send the type of record requested by the last COMMAND record. In some cases the requested data will take more than one record to send. In this case, the K101-D/K102-D will send one record each time it is addressed, or as long as it is addressed, until all of the requested data has been sent. After all requested data has been sent the K101-D/K102-D will not send anything, even though it may be continually addressed to talk.

Talk Only Mode:

LISTENER: The K101-D/K102-D has no listener capability in this mode.

TALKER: When the GPIB SRQ key is pressed on the K101-D/K102-D front panel, the PRINT records for the current screen are sent. If in INTERFACE mode, other "EXTERNAL" functions may be performed locally by entering keys in the GPIB COMMAND field. Keys entered here are processed as if they came over the GPIB bus from an external controller and so should conform to the formats specified. This field is only expected to be used to enter COMMAND record type data (although there is no restriction as to what type of talk records may be included in this field) and may only contain up to 8 characters. The desired GPIB record (up to 8 characters) should be entered, followed by a space (which will be interpreted in this field as a 'carriage return' terminator). The 'delete' key may be used to edit this field. When entered, a 'delete' will cause the most recently entered character to be deleted. If greater than 8 characters are entered, not including deleted characters, the oldest entries are deleted. Only the characters visible in the GPIB COMMAND field will be processed.

Listen Only Mode:

LISTENER: The K101-D/K102-D will process any messages sent across the GPIB. It will not look for its listen address before attempting to process a device dependent message.

TALKER: The K101-D/K102-D has no talker capability in this mode.

IFC Message:

The IFC message will clear the K101-D/K102-D interface (talker, listener, and serial poll states are set to idle). If the K101-D/K102-D is in the process of transmitting a talk record when an IFC occurs, the remainder of the record will be output the next time the K101-D/K102-D is addressed to talk. If the operator wishes to start sending a new record after an IFC, send a Command Record with the desired Talk Record command code.

Device Trigger:

Causes pulse to appear at BNC, located at the rear panel with TTL levels.

Device Clear:

This produces the same results as pressing the stop key on the front panel. In addition, it notifies the GPIB of an unnatural stop and reset the buffer and counters for GPIB transmittal.

K101-D/K102-D GPIB Status Byte:

If the K101-D/K102-D has requested service from the controller, the RQS bit (bit 7) of the STATUS BYTE will be set as defined by the GPIB standard. The RQS bit will remain set until after the controller performs a serial poll or a "CSR" command is received. The other status byte bits indicate the reason service was requested.

The K101-D/K102-D will request service under the following conditions:

1. End of K101-D/K102-D record cycle when not in the Auto Arm mode.
2. SRQ pressed (while in TALK/LISTEN mode) and in local (LOCS) or in local with lockout state (LWLS).
3. Error in power-up diagnostics.
4. GPIB listen record error (see following table).

The status byte bits have the following meaning:

BIT #	DECIMAL VALUE WHEN THIS BIT IS SET		MEANING
8	128		1 = Recording in progress
7	64		1 = K101-D/K102-D service request
6	32		1 = SRQ key pressed
5	16		1 = Error in power-up diagnostics
4	8	>	
3	4	>	Listen Record Error
2	2	>	
1	1	>	

Listen Record Error Codes:

0 = No error

1 = Illegal command code received.

2 = Illegal character received.

3 = Keyboard input error (local or remote source).

4 = Invalid character. Rest of record ignored.

Following a serial poll, all bits except bit 8 are reset.

K101-D/K102-D Parallel Poll:

The PPR (parallel poll response) assigned to the device is represented according to the sense bit (bit 4) of the PPE (parallel poll enable message) and the current service request state (Status byte bit 7) of the device.

Parallel Poll Response

N-A	RQS = 0	RQS = 1
Sense = 0	0	1
Sense = 1	1	0

EG. PPE - 0 1 1 0 1 0 0 0
|="="=> PPR1
└=====> Sense = 1

If RQS is true (service requested), the parallel poll response is 00000001.

If RQS is false then the parallel poll response is 00000000.

A parallel poll will not clear the service request. A serial poll should be conducted to determine the reason for the service request and to clear it.

Interface Mode Selections:

The following GPIB parameters may be selected from the front panel of the K101-D/K102-D using the INTERFACE MODE specify key.

MODE CHOICE - Select GPIB function.

TALK ONLY
LISTEN ONLY
ADDRESS=available address are 00-30 decimal
default address is 09.

END OF MESSAGE CHOICE - Select end of message characters.

CR (carriage return)
CR + EOI (carriage return and set EOI)
CR/LF (carriage return and line feed)
CR/LF + EOI (carriage return, line feed, and set EOI).

K101-D/K102-D Self Test Mode:

The GPIB is inactive when in the Self Test mode. Self Test mode cannot be operated via the GPIB.

4-4. RS-232-C OPERATION

General Description:

The K101-D/K102-D RS-232-C is a full duplex serial channel and provides full modem control for communications using telephone lines. In the INTERFACE mode, the RS-232-C channel baud rates, parity, word lengths, stop bits and protocol may be selected. The record format used by the RS-232-C interface is identical to that used by the GPIB.

Protocols And Errors:

There are two protocols available, "CTS/RTS" and "NAK/ACK." The "NAK/ACK" protocol INCLUDES the "CTS/RTS" protocol.

CTS/RTS: A standard modem/terminal handshake is assumed. The DSR line and CTS line are monitored to determine if a transmission can take place, and the RTS line is used to signal that a message is ready for transmission. This protocol can be defeated by wiring RTS directly to DSR and CTS, in which case a transmission will occur immediately and continue at the selected baud rate until the record is exhausted.

NAK/ACK: For situations where modem control lines are not available and buffering is required, the "NAK/ACK" protocol is used. This adds a software protocol to the previous hardware one. Before transmission in this mode, the receiver is checked for a NAK (Ctrl-S or 13H) character. If one is found, the transmission will not take place. Normally, the receiving device will transmit an ACK (Ctrl--Q or 11H) character when ready, and a NAK when not ready. This allows two devices of different processing speeds to synchronize.

NOTE

When an error is detected in an RS-232-C record, an ASCII NAK (15H) is sent. The conditions which would cause an RS-232-C error are identical to those which cause a service request to be generated in GPIB mode (see GPIB FUNCTIONAL SPECIFICATION - GPIB STATUS BYTE).

Interface Mode Selections:

The following RS-232-C parameters may be selected from the front panel of the K101-D/K102-D using the INTERFACE mode specify key.

Baud Rate - Select transmit/receiver rate in bits per second.

110	600	2400
150	1200	4800
300	1800	9600

Stop Bits - Select number of stop bits associated with each character.

1
2

Parity - Select the parity for each character.

ODD
EVEN
NONE (parity will not be checked)

Word Length - Select the number of bits per character.

7
8

Protocol - The RS-232-C Full duplex protocol to be used.

NAK/ACK
CTS/RTS

4-5. RECORD FORMATS

General Description:

All device dependent messages sent or received by the K101-D/K102-D are coded according to the record formats specified in this document. The record type depends on the type of information to transfer. Records which can be sent by the K101-D/K102-D when it is a talker will be referred to as 'talk records.'

Records which can be received by the K101-D/K102-D when it is a listener will be referred to as 'listen records.'

Record Types:

Keystroke Record:	K101-D/K102-D keystrokes, represented as ASCII character codes. Talk and Listen record.
Memory Record:	K101-D/K102-D measurement data and trace level. Each sample is represented by two hexadecimal digits. Talk and Listen record.
Command Record:	Commands that control the K101-D/K102-D GPIB functions. Listen record.
Status Record:	GPIB Status Byte information and K101-D/K102-D recording status. Talk record.
Display Record:	A string of characters to display on the K101-D/K102-D screen. Listen record.
Print Record:	A copy of the characters displayed on the K101-D/K102-D screen. Talk record.
Port Record:	Data read from specified port. Talk and Listen record.
Acquisition Time Record:	Time, date and trace time for acquisition. Talk and Listen record.
DVM Record:	DVM reading. Talk record.

All of the information sent in a record is ASCII encoded. ASCII spaces and/or commas may be inserted in a record to improve readability (except in Display and Acquisition Time records). There is no limit to the size of listen records. However the K101-D/K102-D talk records do not exceed 80 characters to accommodate controllers with limited input buffer space.

All records begin with a record type character, and end with a terminator character. When using the GPIB interface records may be terminated with a 'CR',

or a 'CR' 'LF'. The terminator character(s) used may be selected locally while in the INTERFACE mode, or remotely by appropriate GPIB keys. GPIB listen records may be terminated in either way.

NOTE

Record Types: Are used for both GPIB and RS-232-C interfaces.

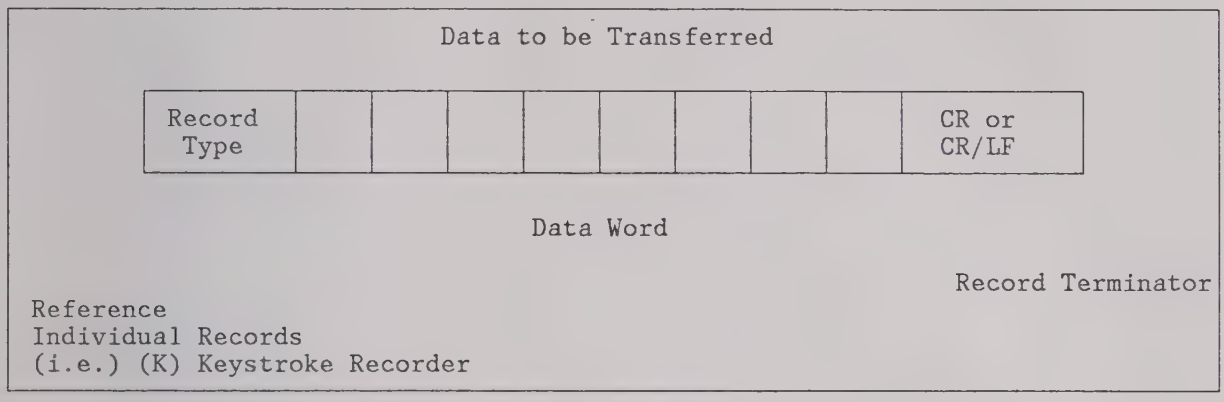

Figure 4-1 General Record Format

NOTE

When using the RS-232-C interface, the CR/LF terminator is always used.

Keystroke Record:

The first character of a Keystroke Record must be a 'K', the record type. The next characters are keystrokes. Each keystroke is represented by one or two ASCII characters as shown in Table 1.

This is an example of 'K' record:

"K / 6 0 / 75 & T 1"/ C R L F.

This keystroke record would cause the following to occur:

1. Set Cursor to 0.
2. Set reference to 5.
3. Timing Display.
4. Set the horizontal expansion factor to Hx3.

Reference Table 4-1.

In addition to the keys available on the K101-D/K102-D keyboard, a "pseudo" key has been provided to blank the CRT display; i.e., point zero (.0).

KEY DEFINITIONS

TABLE 4-1

Page 1 of 2

DESCRIPTION OF KEY	KEYCODE
0, Hx1	0
1, Hx3	1
2, Hx6	2
3, Hx12	3
4, Page down	4
5, V24	5
6,V12	6
7, V6	7
TTL, 8,Page up	8
ECL, 9, EBCDIC	9
A, ASCII	A
B, Binary	B
Sample, C	C
Glitch, D, Decimal	D
Latch, E, Octal	E
Demux, F, Hex	F
G	G
H	H
I	I
J	J
K	K
L	L
M	M
N	N
O	O
P	P
Q	Q
R	R
S	S
T	T
U	U
V	V
W	W
X	X
Y	Y
Z	Z
Don't Care, Asterisk	*
Plus, true	+
Cursor Down	)
Cursor Left	<
Cursor Right	>
Cursor Up	(
Previous	#
Next	%
-Minus, False	-

KEY DEFINITIONS con't.

Page 2 of 2

DESCRIPTION OF KEY	KEYCODE
Data	$D
Timing	$T
Data Format	$F
Graph	$G
Polarity	$P
Trace	$S
Input	$I
Clock	$C
Stop	!0
Move A to B	!1
Move M to A	!2
Select A	!3
Select B	!4
Advance	!5
Compare	!6
Search	!7
Arm	!8
Period	&.
Less than	&<
Equal to	&=
Greater than	&>
Space	&;
Edit	/0
Insert	/1
Delete	/2
Save	/3
Recall	/4
Shift Recall	/5
Set Cursor	/6
Set Reference	/7
Shift Delete	/8
Blank CRT	.0

Memory Record:

The first character of a Memory Record must be an 'M', the record type. The next character selects which memory to change, 'A' or 'B'. The next group of three characters is the beginning sample index of the measurement data. The sample index field must be three ASCII digits, '0' through '9'. There are 515 samples of measurement data in each of A and B memory, referred to as '000' through '514'. The remainder of the record consists of memory data. For the K101-D, one sample is represented by thirteen ASCII encoded HEX characters with the first four representing group C, the next four group B, the next four group A. The last character represents the level at which the sample was recorded. For the K102-D, one sample is represented by nine ASCII encoded HEX characters with the first four representing group B, the next four group A and the last character representing the level at which the sample was recorded. The first character of each group represents channels F, E, D, and C.

This is an example of an 'M' record:

M A 020 0000FFFF0000F 0000FFFF00001 CR LF

NOTE
Commas should not be used.

Command Record:

The first character of a Command Record must be a 'C', the record type. The next characters are command codes. K101-D/K102-D commands fall into two groups. The first group of commands tell the K101-D/K102-D what type of record to send the next time it is addressed to talk. The second group causes the K101-D/K102-D program counter to jump to a specific RAM address or causes the K101-D/K102-D to begin a call at a given RAM address. If more than one command is given in a Command Record, only the last will be processed.

K101-D GPIB Command Codes:

CA Send the keystrokes for setting up the CLOCK SELECT.

CB Screen for the memory requested.

CM (K Record(s).)

CU Send a keystroke record for setting the cursor and reference for both memories A and B to their current values. (K Record.)

PS Send Print Records. (Record.)

FM Send the keystrokes for setting up the Data Format screen. (K Record.)

IA Send the keystrokes for setting up the INPUT screen for

IB the memory selected.

IM (K Record.)

IO Send data from specified I/O port xx. (I Record.)

This is an example of a 'C' record: "C M A, C R L F."

MB ...

MA Send the measurement data from the memory locations. Between and including the cursor and reference positions. If CURSOR>REFERENCE send data from cursor to end of memory for memory specified. (M Record(s).)

PA Send the keystrokes for setting up the LOGIC POLARITY

PB screen for the memory specified.

PM (K Record (s).)

SB ...

SA Send the keystrokes for setting up the TRACE SELECT screen for the memory specified.

SM (K Record(s).)

SR Send a Status Record. (S Record), and clear status byte; i.e., ASCII representation of the serial poll status byte plus a status indication.

TA Send data for the Acquisition time for the memory selected.

TB (T Record.)

VM Send DVM record (V Record); i.e., voltmeter reading.

ZM Send the keystrokes for setting up the INTERFACE screen. (K Record.)

Status Record:

The first character of a Status Record must be an 'S', the record type. The next group of eight characters represents the value of the GPIB Status Byte. The value of each bit of the GPIB Status Byte is encoded as an ASCII 0 or ASCII 1. The value of the MSB (bit 8) is given first, down through the LSB (bit 1). A comma starts the next field, the 'K101-D Recording Status' field. The recording status describes the current status of the K101-D/K102-D recording cycle. The first character in this field is the Recording Status Code, a number between '0' and '3'. This character is followed by a comma. The next four characters are the recording status message that is displayed in the lower right corner of the K101-D/K102-D display.

K101-D/K102-D RECORDING STATUS CODE

0	RDY
1	BUSY
2	CLK?
3	xxxx (Pass Count)

This is an example of an 'S' Record, shown with spaces for clarity:

S 0 1 0 1 0 0 0 0, 0 RDY CR

Display Record:

This record displays a string of characters, starting at a given location on the K101-D/K102-D screen. The position of the message is given as a row and column. There are 52 columns across the screen and 29 rows down the screen. However, the top-most and bottom-most rows (1 and 29 respectively) are not accessible to the GPIB.

The first character of a Display Record must be a 'D', the record type. The next four characters are the row and column positions. Two ASCII encoded decimal digits are used for the row, and two for the column. The range of row values is '2' through '28'; the range for column values is '1' through '52'. If the specified row is out of range, row position '2' is used. If the specified column is out range, column position '1' is used. The remaining characters constitute the message to be displayed. The row and column positions will be automatically

incremented until row '28', column '52' has been displayed. If there are still more characters to display, the remainder of the message will be printed starting at row '2', column '1'.

This is an example of a 'D' Record:
This is an example of a Display Record: D0322CR.

NOTE
Commas inserted between the row and column will cause errors with this command.

Print Record:

This record is used to output the current screen display. The K101-D/K102-D will send one record for each row of characters displayed on the screen. This record is provided so that a picture of the current K101-D/K102-D screen may be sent to a printer. This type of record will not be recognized by another K101-D/K102-D.

The first character of a Print Record is a ".", the record type. The next 52 characters are the ASCII characters displayed on one row of the K101-D/K102-D screen.

This is an example of a Print Record:
"." CLOCK=0020 nSEC GPIB=LOCS V=-00.00 17:42:13 MEM=M.

Port Record:

The first character of a Port Record is a 'P', the record type. The next two characters indicate the I/O port number from which the data was taken. These are in ASCII encoded HEX. The last four characters indicate the data read from the port, formatted as ASCII encoded HEX with the most significant digit being transmitted first.

This is an example of a Port Record: I, 01, 16BA, CR.

NOTE
To request a Port record: CIO XX.

Acquisition Time Record:

The first character of an Acquisition Time Record is a 'T', the record type. All characters in this record are ASCII. The next character indicates which memory the data represents, 'A' or 'B'. The next eight characters indicate the time at which the acquisition was taken (normally formatted HH:MM:SS). The next eight characters indicate the date (MM/DD/YY). The last ten characters indicate the trace time.

This is an example of an Acquisition Time Record: TA10:55:0105/20/8110 nanoseconds CR.

DVM Record:

The first character of DVM Record is a 'V', the record type. The next six characters are all ASCII and indicate the DVM reading.

This is an example of a DVM Record: V+20.48 CR.

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